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# The use of seasonally resolved temperature data to identify the cause of marine climate change

Andrew Johnson (1), Annemarie Valentine (2), Melanie Leng (3), Hilary Sloane (3), Bernd Schöne (4), and Donna Surge (5)

(1) Department of Natural Sciences, University of Derby, Derby DE22 1GB, UK (a.l.a.johnson@derby.ac.uk), (2) Student Advice and Support Services, Loughborough University, Loughborough LE11 3TU, UK, (3) Isotope Geoscience Facilities, British Geological Survey, Keyworth NG12 5GG, UK, (4) Institute of Geosciences, University of Mainz, 55128 Mainz, Germany, (5) Department of Geological Sciences, University of North Carolina, Chapel Hill 27599-3315, USA

On the continental shelf of the eastern USA, seasonal variation in water temperature is much lower south of Cape Hatteras than it is to the north as a result of the influence of warm currents, which raise winter temperature. High temperatures north of Cape Hatteras during the Pliocene have been attributed to greater northward penetration of warm currents in the absence of a feature analogous to Cape Hatteras. However, oxygen isotope thermometry using serial ontogenetic samples from scallops reveals a high seasonal temperature range at some horizons, suggesting that overall warming was the consequence of general climate change, with the absence of a 'Cape Hatteras' feature allowing greater southward penetration of cold currents, resulting in low winter temperatures at a southerly latitude. Evidence from other taxa indicates that at times seasonal variation in water temperature was quite low and that there was greater northward penetration of warm currents. This may relate to increases in vigour of the Gulf Stream. The study shows how seasonally resolved temperature data can assist identification of the driving forces of marine climate change.